STATE OF LOUISIANA
DEPARTMENT OF HEALTH AND HOSPITALS

LOUISIANA
Department of HEALTH and HOSPITALS

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M E M O R A N D U M

DATE: **August 25, 2000**

TO: **R. Douglas Vincent, Chief Engineer, Engineering Services, OPH**

FROM: **Mark S. Wilson, Hydogeologist**
Safe Drinking Water Program, OPH

RE: **Final Report of the Groundwater Under the Direct Influence of Surface Water Project for Non-Community Public Water Systems in the State of Louisiana.**

Introduction:

A study has been completed to determine and identify if any groundwater wells for Non-Community Public Water Systems are Under the Direct Influence of Surface Water. This project is part of the 1986 Amendments to the Safe Drinking Water Act, pertaining to the Surface Water Treatment Rule. The Surface Water Treatment Rule requires that Public Water Systems (PWS) install disinfection and filtration equipment if they obtain their drinking water from surface water or from groundwater that is directly influence by surface water bodies. Any PWS water well that meets the criteria of Groundwater Under the Direct Influence of Surface Water (GWUI) is a public health concern, as there is a risk of waterborne diseases from such microorganisms as Cryptosporidium or Giardia.

Microscopic Particulate Analysis (MPA) involves field and laboratory techniques, as specified in EPA Method 1622 and 1623, used to determine the identification of potentially harmful protozoans found in drinking water. *Cryptosporidium* oocysts and/or *Giardia* cysts are two of the most common microorganisms that are used to determine if a water well is subject to Ground Water Under the Direct Influence of Surface Water (GUDIS). These microorganisms, derived from the fecal matter of warm-blooded animals, are carried downstream or accumulated in a surface water body, and enter a water well through migration in the unsaturated zone (also known as the vadose zone), or directly into the fresh-water aquifer due to inadequate cementation of the well surface casing. Direct contamination around improperly bonded surface casing usually occurs

during flooding.

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The results of this project are based on an interagency focus of the Louisiana Office of Public Health (OPH) Safe Drinking Water Program (SDWP), the United States Army Corps of Engineers (COE), Louisiana Department of Transportation and Development (DOTD) Water Resources Section (WRS), the Louisiana Department of Environmental Quality (DEQ) Aquifer Evaluation Section, and Microscopic Particulate Analysis (MPA) by Clancy Environmental Consultants, Inc. of St. Albans, Vermont. Regional sanitarians and engineers in the OPH SDWP provided valuable time and information regarding the physical location of water wells for using differentially corrected Global Positioning Satellite (GPS) equipment, locating the distance of these wells from surface water features which was determined by using a laser range finder for increased accuracy, MPA sampling of suspect wells, and final sanitary surveys including colliform bacteria sampling.

Methodology

The State of Louisiana criterion used to exempt a PWS groundwater well from MPA testing, are the following:

- Criteria 1: distance of 200 feet or more, horizontally, from a surface water feature. A surface water feature is defined as an area continuously inundated with flowing or standing water. Wetlands or low lying areas that are only periodically flooded are not considered surface water features.

- Criteria 2: the screened interval of the well is separated from the surface water feature by a confining layer. A confining layer is defined as a continuous, extensive geologic unit of low permeability.

- Criteria 3: if the groundwater source well cannot meet the exemption factors detailed in Criteria 1 or 2 above, the water well must meet all of the following in order to be exempt from MPA testing:

    1. the top of the well screen must be 50 feet or more below the ground surface,
    2. the well must have a pumping rate less than or equal to 500 gallons per minute when on-line,
    3. the well must have a properly installed sanitary seal, and
    4. water quality sampling shows no total coliform contamination, or any correlation between the groundwater source and the surface water source with respect to turbidity, temperature, pH, and conductivity.

All of the Community PWS wells have already been analyzed with the COE Geographic Information System (GIS) technology with a final report being presented, after MPA testing, in April of 1998 (see Appendix A). The results of that report are as follows:

?? Community PWS wells evaluated	2605
?? Number remaining after COE GIS study	287
?? Number sent to Regions for field verification	204
?? Number subject to MPA evaluation	33
?? Number requiring 3 rounds of MPA plus Bac-T sampling	7
?? Final determination of GUDIS for Community PWS for the State of Louisiana	0

The total number of Non-Community transient and non-transient wells in the State of Louisiana is approximately 829 representing 641 systems. The initial problem encountered in this project was the discovery that approximately 400 wells did not have longitude and latitude GPS parameters. It was decided to determine whether these wells are within 200 feet of a water body through contact with the appropriate regional offices for field verification, prior to actual GPS use. In the meantime, the COE began plotting the previously acquired latitude and longitudes of the remaining 429 wells on hydrologic maps with their GIS capabilities, and updating the data with newly acquired GPS parameters. The distances to surface water bodies was also field verified for the plotted hydrologic maps, in addition to acquiring new GPS parameters for the wells.

The results of this extensive field proofing are that out of 829 total wells, 56 non-community PWS wells are located within 200 feet of a surface water-body (see Table 1). This list of 56 wells was sent to the Army Corps of Engineers to begin the next phase of the project, being the ordering of the Driller's Logs from the D.O.T.D. by the COE's geotechnical department, to determine wells screened in fresh-water aquifers that are separated from the surface water feature by an extensive geologic unit of low permeability.

Well Data Analysis and Results

The Army Corps of Engineers used the list of 56 field-verified wells to determine if any satisfy Criteria 2, which is the presence of a geologically extensive, confining clay-type layer of low permeability. The complete analysis involved D.O.T.D driller's logs, geologic maps, geologic cross sections defining the subsurface lithology, topographic maps, engineering geology maps, and borings information. Of the 56 water wells that were investigated, 48 have a confining clay layer and 8 water wells are MPA testing candidates, as they do not have a clearly delineated confining layer or there was no data available for this determination.

These 8 wells are listed as the following:

PWS Number	Parish	Well Name
2063019	Livingston	Carthage Bluff Well
2077008	Point Coupee	Old River Well #4
2077008	Point Coupee	Old River Well #5
2077008	Point Coupee	Old River Well #6
2077019	Point Coupee	Old River Well #2
2077019	Point Coupee	Old River Well #3
2077027	Point Coupee	Old River Landing
2077047	Point Coupee	Old River Well #7

As described in the COE report (Appendix B), problems arose in matching the well databases of the D.O.T.D. and OPH SDWP. The well databases from the two State agencies use a different numbering system, different well owner names, and in many instances the latitude and longitude coordinates did not correlate. Therefore, the COE conducted an extensive comparison of well data within the proximity of the OPH SDWP wells. The results of this data investigation are these 8 wells that are either lacking a clearly discernible clay layer, or there was insufficient data to make this lithologic decision, thus necessitating the inclusion of these suspect wells on the list for MPA testing.

MPA Testing and Results

Carthage Bluff Well (PWS 2063019) in Livingston Parish

The closest well match is 420 feet deep and has 3 thick clay layers prior to the produced fresh-water aquifer. The first one is 205 feet thick from 5 feet to 210 feet, the second is 35 feet thick at a depth of 225 to 260 feet, and the third clay layer is 60 feet thick from 280 to 340 feet. The system does not chlorinate due to a waiver, and has never had a positive bacteriological sample. According to the State guidelines, any system with a waiver that has a positive bacteriological sample must install continuous disinfection equipment, the most economical for smaller systems would be a liquid chlorine injection system.

The well was MPA tested on the 18th and 19th of April 2000, with the results showing no detected bioindicators in the sample. This well was eliminated from further MPA testing and is considered to not be under the influence of surface water because of the 3 thick clay layers above the water producing sand, bacteriological sampling history, and no bioindicators present in the sample.

Old River Wells 4, 5, and 6 (PWS 2077008) in Point Coupee Parish

Geologic data was not available for these 3 wells and therefore each was MPA tested 3 times followed by a sanitary survey and bacteriological sampling. All 3 wells displayed algae bioindicators in each test, with the exception of Well 5 where in the third round of MPA testing it did not show any algae levels. Other bioindicators including *Giardia* cysts or *Cryptosporidium* oocysts were not detected in any of the sampled wells.

The Old River Well 4 has a Moderate risk for surface water contamination according to the EPA consensus method, as indicated below:

Sample Date	Well #	Algae Risk Factor	Risk for GUDI
08-16 May 00	4	14	Moderate
14-19 June 00	4	12	Moderate
26-31 July 00	4	14	Moderate

The sanitary survey revealed that the top of the well casing is not 2 feet above the highest flood level that may have occurred in a ten year period as specified in the State Sanitary Code (12:008-8). The bacteriological sample taken on 26 July 2000 was negative.

The Old River Well 5 has a Low risk for surface water contamination according to the EPA consensus method, as indicated below:

Sample Date	Well #	Algae Risk Factor	Risk for GUDI
08-16 May 00	5	14	Moderate
14-19 June 00	5	09	Low
26-31 July 00	5	00	Low

This well exhibited 2 consecutive Low risk factors that eliminates this well from further MPA study. The sanitary survey revealed that the top of the well casing is not 2 feet above the highest flood level that may have occurred in a ten year period as specified in the State Sanitary Code (12:008-8). The bacteriological sample taken on 26 July 2000 was negative.

The Old River Well 6 has a Moderate/Low/Moderate risk for surface water contamination according to the EPA consensus method, as indicated below:

Sample Date	Well #	Algae Risk Factor	Risk for GUDI
08-16 May 00	6	14	Moderate
14-19 June 00	6	09	Low
26-28 July 00	6	14	Moderate

The sanitary survey revealed that well #6 had a leak at a PVC coupling near the wellhead in violation of the State Sanitary Code (12:012-1), and the top of the well casing is not 2 feet above the highest flood level that may have occurred in a ten year period as specified in the State Sanitary Code (12:008-8). The bacteriological sample taken on 26 July 2000 was negative.

Old River Wells 4, 5, and 6 (PWS 2077008) are deemed to not be under the influence of the adjacent surface water because of the following reasons:

- The detection of algae as the only bioindicator is inconclusive.
- All of the wells are subject to flooding until the well casings are extended to the required 2-foot height above the flood level as will be monitored by the SDWP Regional Sanitarian.
- Bacteriological samples, taken on 26 July 2000, are negative for the 3 wells.
- The system does not have continuous disinfection (such as liquid chlorination) and they have a valid variance, without a history of bacteriological violations.

Old River Wells 2 and 3 (PWS 2077019) in Point Coupee Parish

Old River Well #2 is inactive and therefore was not subjected to MPA testing.

MPA testing from the 8th to the 12th of May 2000 was conducted on Old River Well #3. *Giardia* cysts or *Cryptosporidium* oocysts were not detected in any of the sampled wells, nor were any other bioindicators detected in the testing.

This well was eliminated from further MPA testing and is not considered to be under the influence of surface water because bioindicators were absent in the sample, and the system currently has a disinfection waiver without a history of bacteriological violations.

Old River Landing (PWS 2077027) in Point Coupee Parish

The Old River Landing well was sampled for MPA testing on the 8th to the 16th of May 2000. Although Nematodes/Eggs were noted in the MPA analysis, these were the only bioindicators present. In the Standards of Identity section of the EPA Consensus Method for Determining Groundwaters Under the Direct Influence of Surface Water Using Microscopic Particulate Analysis (MPA), the presence of Nematodes and/or their eggs are "of little assistance in determining GWDI". *Giardia* cysts or *Cryptosporidium* oocysts were not detected in the sampled well, nor were any other bioindicators detected in the testing.

This well was removed from further MPA testing and is considered to be not under the influence of the surface water body. The presence of Nematodes/Eggs is inclusive evidence of the well being under the direct influence. This system does not chlorinate due to an exemption by a disinfection waiver and has not had a history of bacteriological violations.

Old River Well #7 (PWS 2077047) in Point Coupee Parish

From the 8th to the 16th of May 2000, MPA testing was conducted on Old River Well #7. *Giardia* cysts or *Cryptosporidium* oocysts were not detected in the sampled well, nor were any other bioindicators detected in the testing.

This well was eliminated from further MPA testing and is not considered to be under the influence of surface water because bioindicators were absent in the sample, and the system currently has a disinfection waiver without a history of bacteriological violations.

Conclusions

The completed study to determine and identify if any Non-Community transient and non-transient groundwater wells for Public Water Systems are Under the Direct Influence of Surface Water provided the following data:

?? Non-Community PWS wells evaluated	829
?? Number within 200 feet of a water body as determined by field verification	56
?? Number remaining after COE GIS/Well Log study	8
?? Number subject to MPA evaluation	7
?? Number requiring 3 rounds of MPA testing, sanitary surveys, and bacteriological sampling	3
?? Final determination of GUDIS for Non-Community PWS for the State of Louisiana	0

The Old River Wells 4, 5, and 6 of PWS ID 2077008 are located in close proximity to the Raccourci Old River that is an abandoned channel of the Mississippi River. This riparian depositional environment allowed sands, silts, and clay to become the basis of the unsaturated or vadose zone. As in most regions of Louisiana, inter-bedded clay layers provide an effective seal above and below the fresh-water aquifer in most areas of Point Coupee Parish. The geologic concern of this area is intercommunication based transmissivity of fluids from deposited sands in scour and fill channel structures as the Mississippi River system changes its flow patterns. MPA testing is important in these types of geologic regimes especially with Old River Wells 4, 5, and 6 being in close proximity to the surface water body, the screened interval or total depth of these wells is

not recorded, and because of the potential for interconnectedness of previously deposited sands that may become recharged during flood stages.

There are at least 9 different fresh water producing sands in Pointe Coupee Parish with statigraphic correlations possible to other regions of the State, especially West Baton Rouge Parish. These sands dip in a southerly direction becoming progressively deeper with the Alluvial aquifer being the shallowest, Zone 1 having three sands, Zone 2 also has three sand intervals, and the deepest being Zone 3 with two producing sand layers.

The latitude and longitude GPS coordinates of Wells 4, 5, and 6 of PWS ID 2077008 were used for searching the D.O.T.D. well files database for determining the approximate sand producing interval and depth of these MPA tested candidates (Table 2). This interval is an average of 553 feet for wells with known depths. According to the Water Resources Bulletin Number 11, the total depth of PC-68 is 615 feet, and the screened interval is 595 to 615 feet. This well is located within one mile of Old River Well #6 and is producing out of the Zone 2 sands that are deeper than the shallower Alluvial aquifer.

The D.O.T.D. database did not have any wells producing in sands less than 50 feet in the northern part of Point Coupee Parish, however; there were wells that were drilled prior to the State regulations that now require this information on the driller's permit. Due to the unknown depth and screened interval of Old River Wells 4, 5, and 6 (PWS 2077008) these wells were definitely candidates for MPA testing.

As the sanitary survey for these wells revealed, the problems associated with the growth of algae or biofilm are <u>not</u> a result of Groundwater Under the Direct Influence of Surface Water. These noted problems can be eliminated from the system with proper maintenance of the wells by repairing all leaks and extending the surface casings to their proper heights. Continuous disinfection would also eliminate the growth of algae and biofilm in the system; however, the system has a valid waver with no history of bacteriological violations and until a positive bacteriological sample is detected, the system is not required to disinfect the produced drinking water. This system may be mandated to install continuous disinfection, such as a liquid chlorine injection pump, in the near future even without a positive bacteriological sample if the EPA proposed Groundwater Rule, which has a section requiring mandatory disinfection, becomes finalized this year.

References:

1. Groundwater Under the Direct Influence of Surface Water (Community Public Water Systems), Final Report, April 1998.

2. Surface Water Influence Analysis, Planning Assistance to States Study, U.S. Army Corps of Engineers, NOD, April 2000.

3. Consensus Method for Determining Groundwater Under the Direct Influence of Surface Water Using Microscopic Particulate Analysis (MPA), U.S. EPA, October 1992.

4. Water Resources of Pointe Coupee Parish, Louisiana, Water Resources Bulletin No. 11, State of Louisiana Department of Conservation, Louisiana Geological Survey, and Louisiana Department of Public Works, in cooperation with the USGS, March 1968.

MSW/msw

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